

# CAM Diagnostics for the Super CAM

Bill Collins, UCB and LBL

*Simulation:* Marat Khairoutdinov and Dave Randall

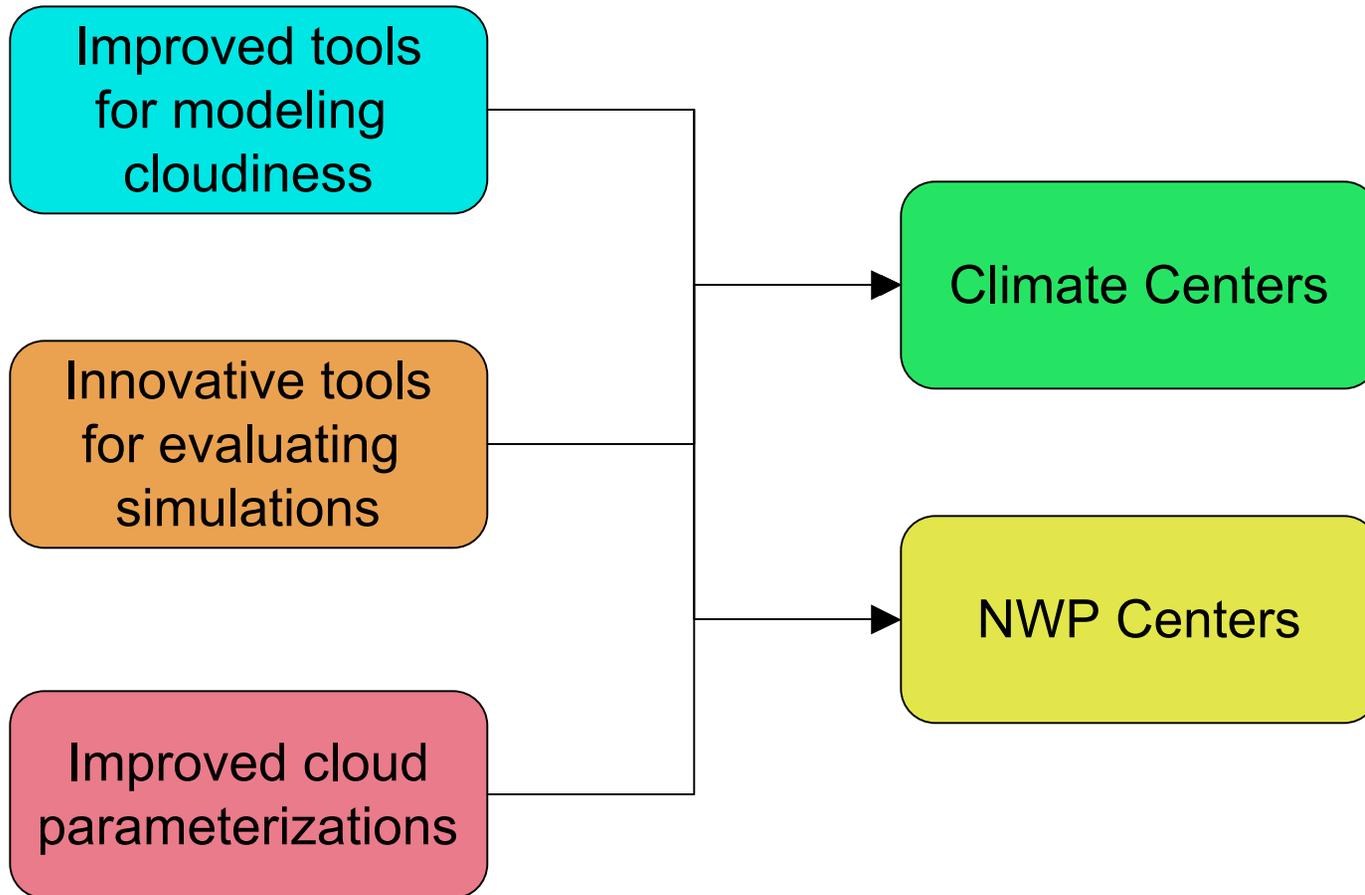
*Analysis:* Rodger Ames, Mark Branson, Kelley Wittmeyer



CMMAP STM Meeting  
UCLA, 15-17 Jan. 2008



# Goals of KT Theme



# Recommendations & General Action Items

*(Previous STMs)*

## Near-term Action Items:

- Develop student/post-doc interactions among CMMAP and modeling centers.
- **Subject MMF to same tests used by climate community.**
- It is vitally important to analyze MMF in frameworks familiar to modeling centers:
  - NCAR diagnostic package
  - GFDL diagnostic package
  - NCEP diagnostic package
- This will help centers understand the implications of MMF using critical diagnostics for their applications.

# The AMIP Simulation with Super CAM

- *Simulation:*  
19-year long AMIP style simulation using the 1985-2004 sea surface temperature (SST) and sea ice distributions
- *Manuscript:*  
***Evaluation of the simulated interannual and subseasonal variability in an AMIP-style simulation using the CSU Multi-scale Modeling Framework***  
Marat Khairoutdinov, Charlotte DeMott, and David Randall  
  
In press, *J. Climate*
- *Websites for diagnostics:*  
CMMAP -> Research -> Themes -> KT to Centers



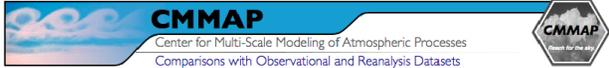
Knowledge Transfer

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# Mean and Variability Diagnostics

AMWG Diagnostics Plots file:///Users/wcollins/Documents/CMMAP/STM\_0108/spcam30\_4...



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Comparisons with Observational and Reanalysis Datasets

[NCAR CCSM Atmospheric Model Working Group Diagnostics Package](#)  
[PCMDI AMIP Page](#)  
[Marat's SPCAM Preprint](#)  
**spcam30\_4km\_32c**

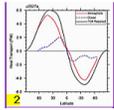
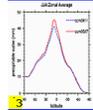
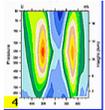
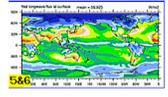
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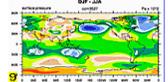
**Set Description**

- 1 [Tables](#) of ANN, DJF, JJA, global and regional means and RMSE.
- 2 [Line plots](#) of annual implied northward transports.
- 3 [Line plots](#) of DJF, JJA and ANN zonal means
- 4 Vertical [contour plots](#) of DJF, JJA and ANN zonal means
- 5 Horizontal [contour plots](#) of DJF, JJA and ANN means
- 6 Horizontal [vector plots](#) of DJF, JJA and ANN means
- 7 Polar [contour and vector plots](#) of DJF, JJA and ANN means
- 8 Annual cycle [contour plots](#) of zonal means
- 9 Horizontal [contour plots](#) of DJF-JJA differences
- 10 Annual cycle line [plots](#) of global means
- 11 Pacific annual cycle, Scatter plot [plots](#)
- 12 Vertical profile [plots](#) from 17 selected stations
- 13 ISCCP cloud simulator [plots](#)

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*Click on Plot Type*

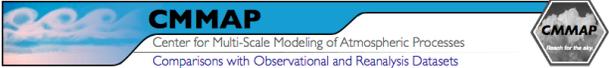








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AMWG Variability Plots file:///Users/wcollins/Documents/CMMAP/STM\_0108/VDIAG\_sp...



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**NCAR CCSM Atmospheric Model Working Group Variability Diagnostics**

Dave Williamson's [Draft](#) of the WGENE Standard Diagnostics of Variability.

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**6-Hourly Data [plots](#)** (\*used daily data for this simulation as 6-hourly data not available)

- Wavenumber-frequency power spectra plots

**Daily Data [plots](#)**

- Hovmöller plots of 200 mb velocity potential
- Madden-Julian Oscillation index plots
- Precipitation rate histograms

**Monthly/Seasonal Data [plots](#)**

- Equatorial Pacific Hovmöller plots of anomalies
- Timeseries of surface temperature anomalies
- Timeseries of Niño 1&2, Niño 3, Niño 4 anomalies
- Timeseries of precipitation anomalies
- Timeseries of total cloud amount anomalies
- Timeseries of sea-level pressure anomalies
- EOFs of N Pacific and Atlantic winter 500 mb geopotential height
- Amplitude and phase of annual cycle of precip and 2-meter temp

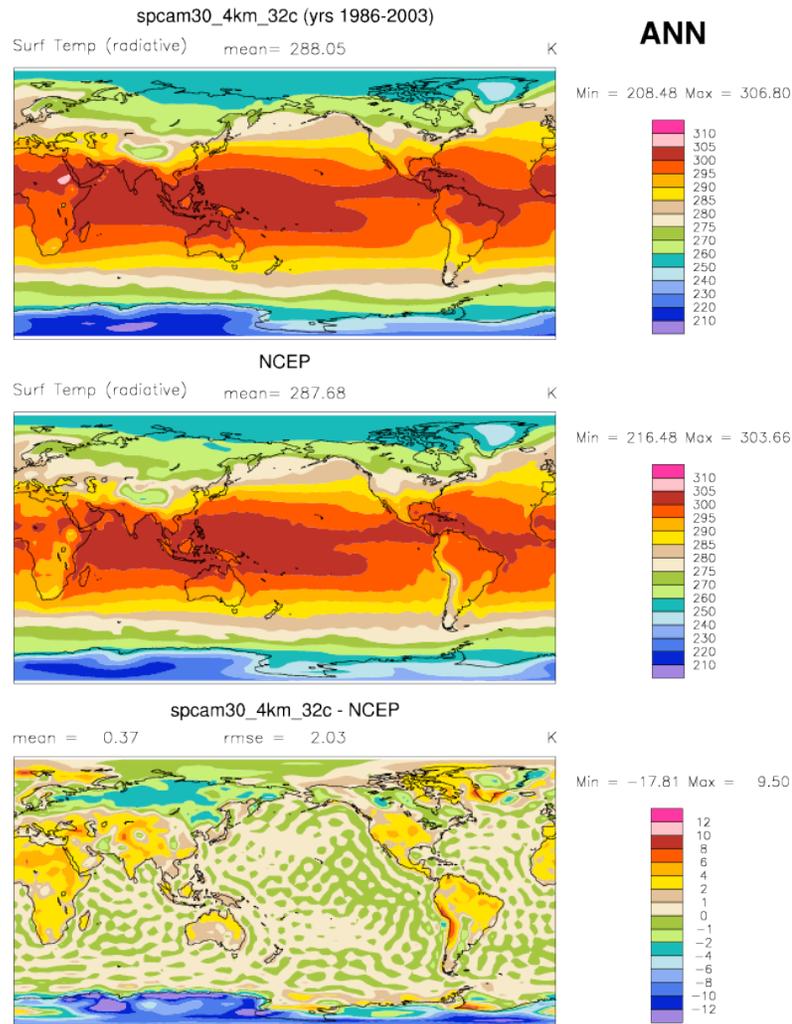
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send questions and comments to [Mark Branson](#)

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# Surface Temperature



- Super CAM has small mean errors in surface temperature (by design).
- Super CAM tends to overestimate tropical land surface temperatures.
- Fidelity of high-latitude land surface temperatures is much better than CAM.

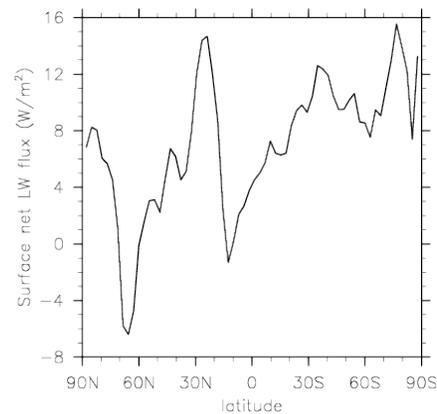
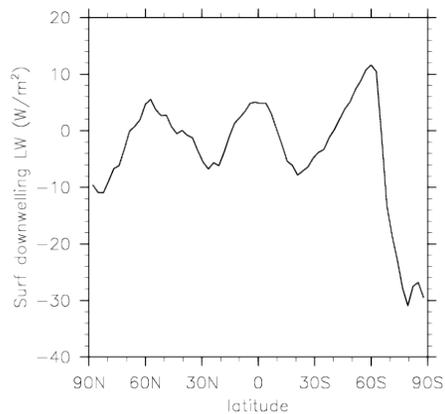
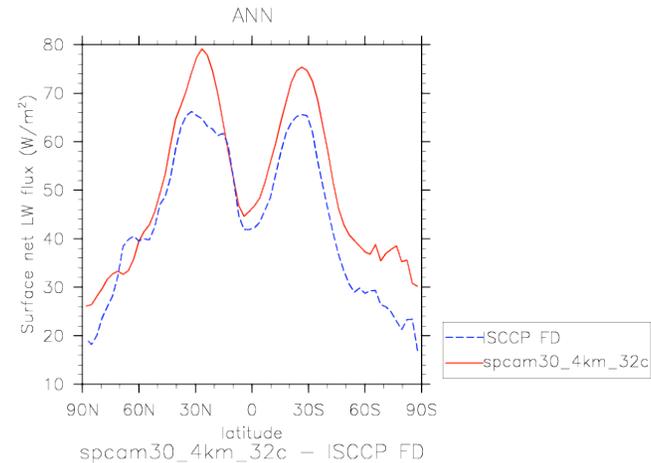
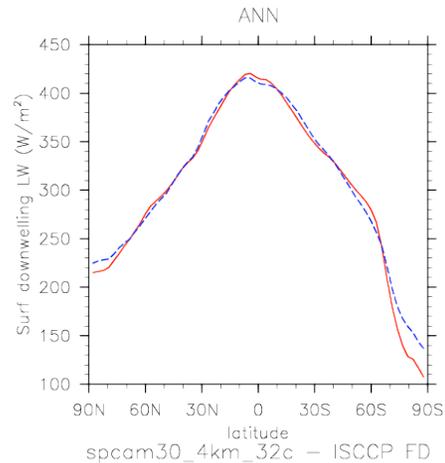


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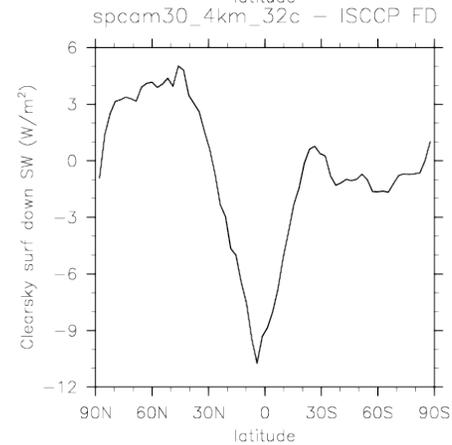
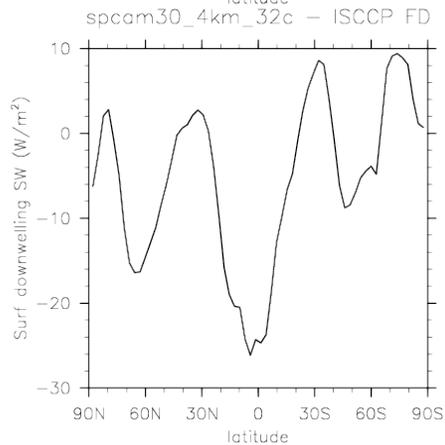
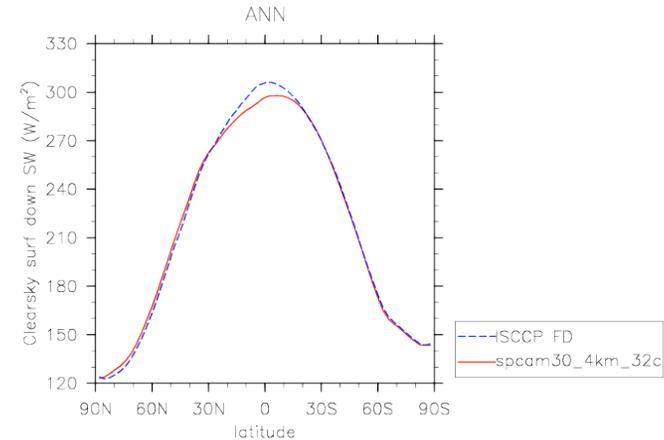
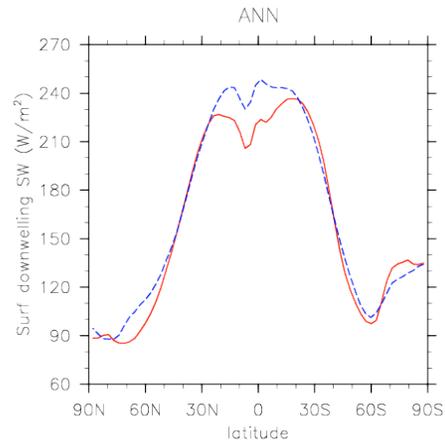
# Surface Longwave Fluxes



- Downward longwave fluxes agree with observations.
- Net longwave fluxes are affected by temperature biases.



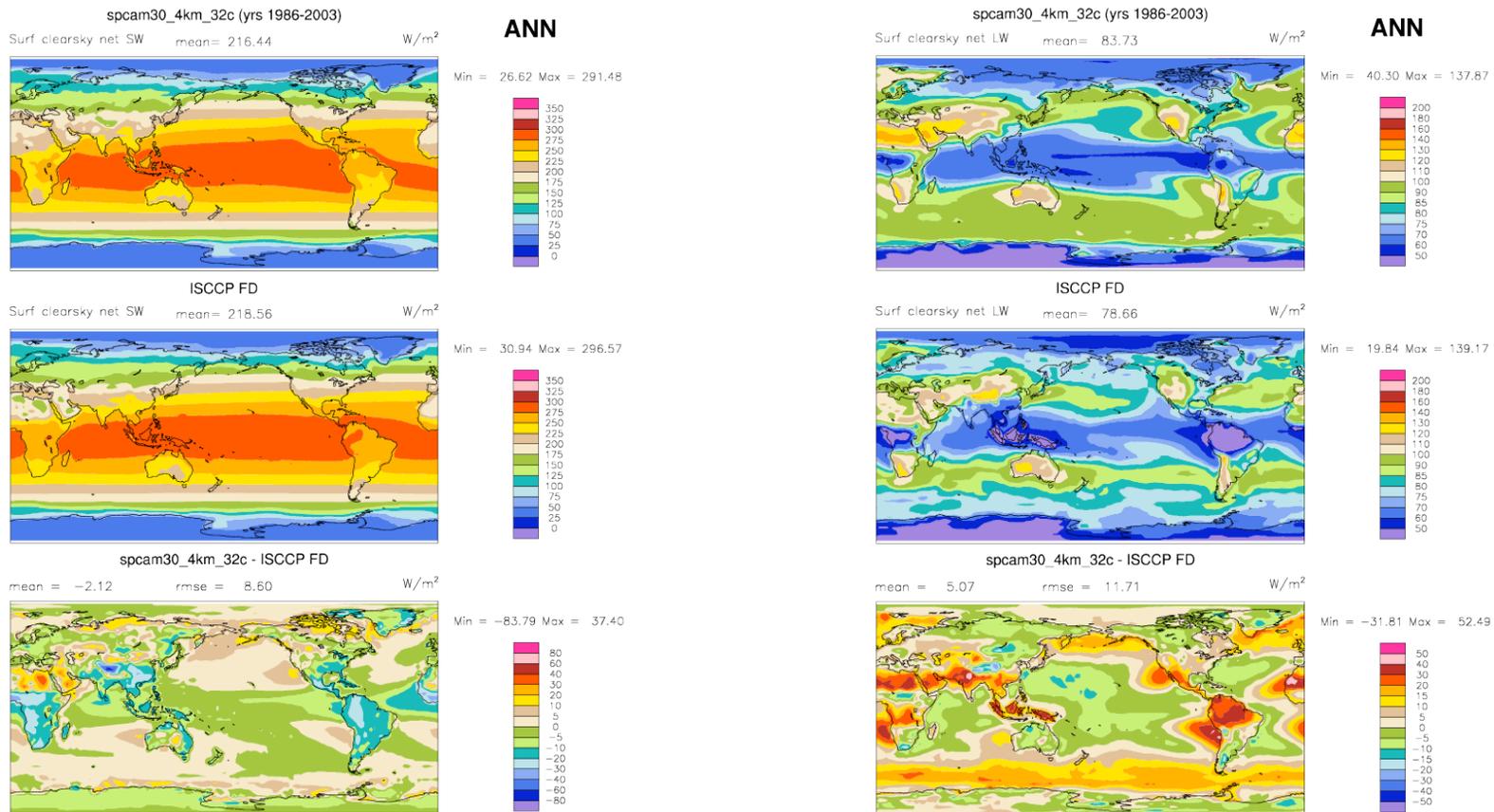
# Surface Shortwave Fluxes



- Downward shortwave fluxes are low in the tropics.
- These biases appear for the cloud-free atmosphere.



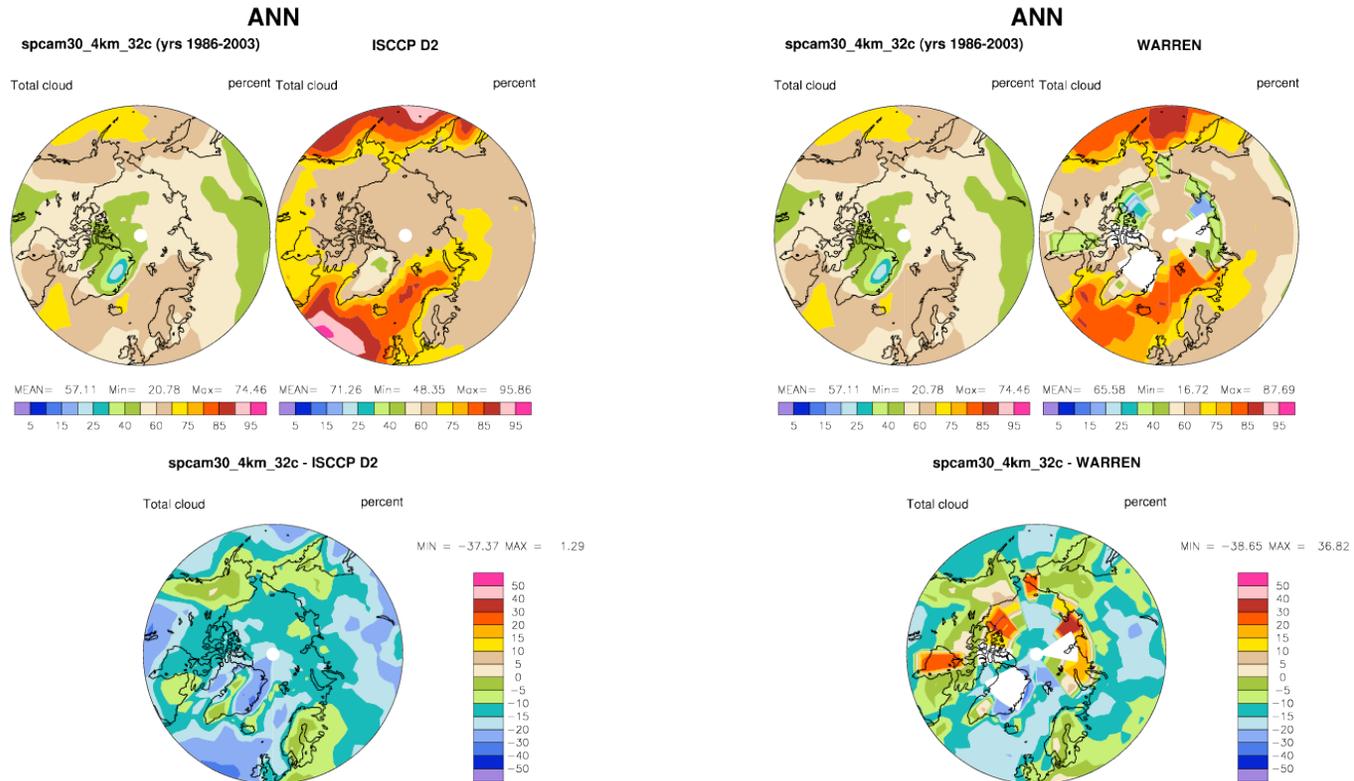
# Surface Radiative Clear-Sky Fluxes



- Largest biases in clear-sky fluxes occur over tropical land.
- Biases in longwave from temperature; shortwave from ?



# Northern Mid-latitude / Polar Clouds

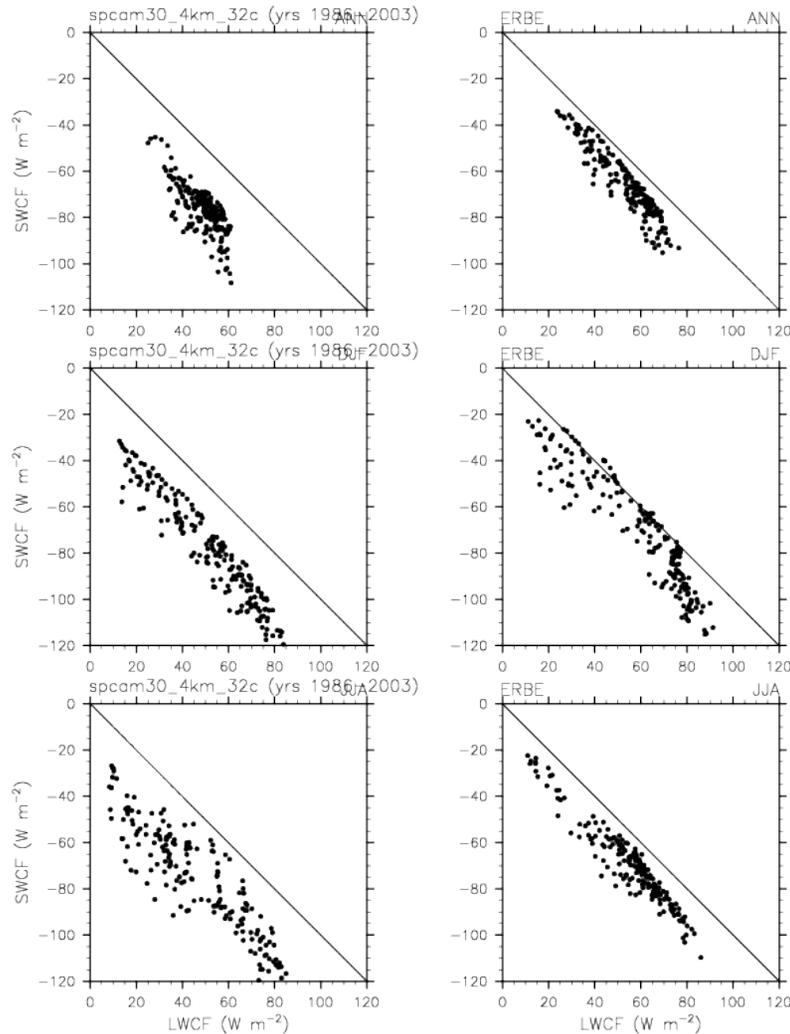


- Mid and high-latitude cloud amounts are underestimated.
- What is the fidelity of mid-latitude storm systems?



# CRE Cancellation over the Warm Pool?

## Warm Pool SWCF vs LWCF

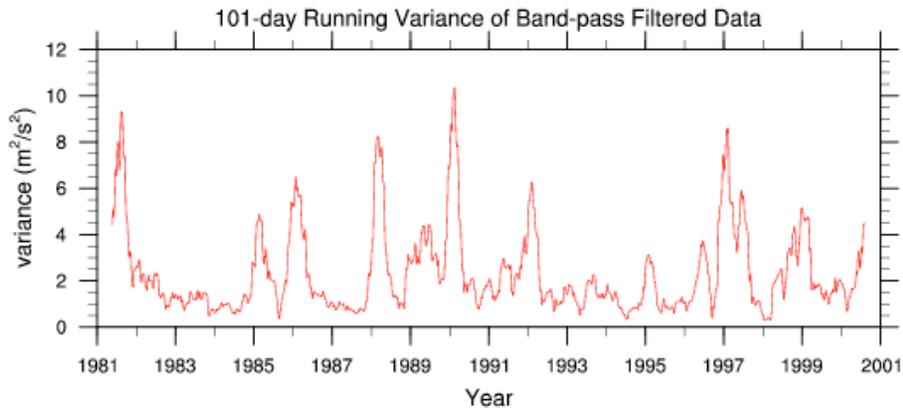


- Super CAM reproduces correlation of SW and LW CRE found in observations.
- Super CAM tends to overestimate SW cloud forcing over the warm pool.

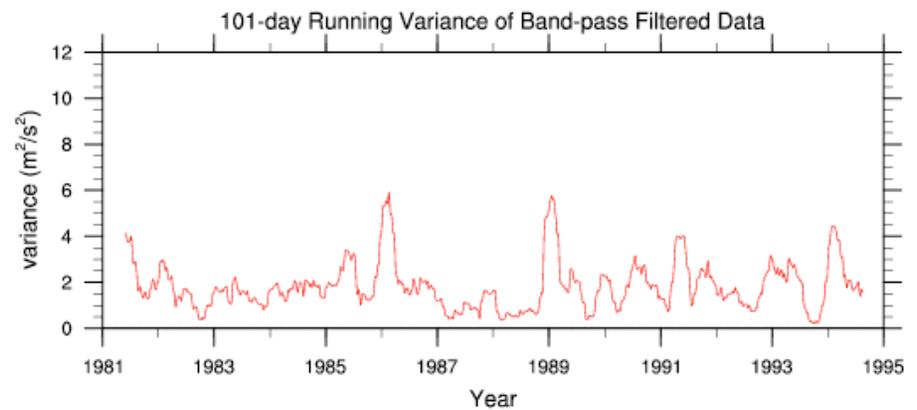


# MJO Daily Variability

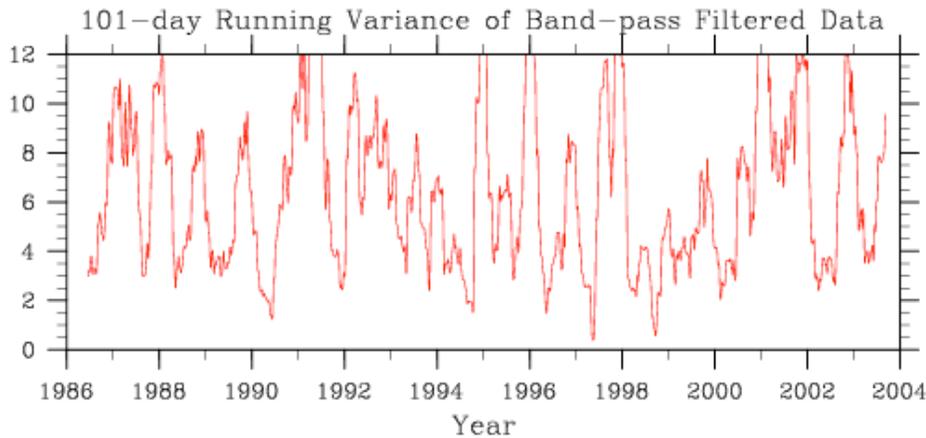
NCEP



CAM3



Super CAM



As CMMAP has established:

- CAM's MJO is weak in all measures.
- Super CAM has much stronger MJO.



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# Next Steps

- Research opportunities using Super CAM diagnostics  
*Discussion during Breakout 1, this afternoon*
  - Surface coupling and clear-sky surface energy budgets
  - Mid-latitude cloud systems
  - Energy budget of the TWP
- Presentation of these results with the CCSM Atmospheric Model Working Group (AMWG)
- Extension to GCSS test cases.
- Interactions with CFMIP-2
- Understanding issues regarding coupling
- Fidelity of short-range predictions (CAPT, NWP)

